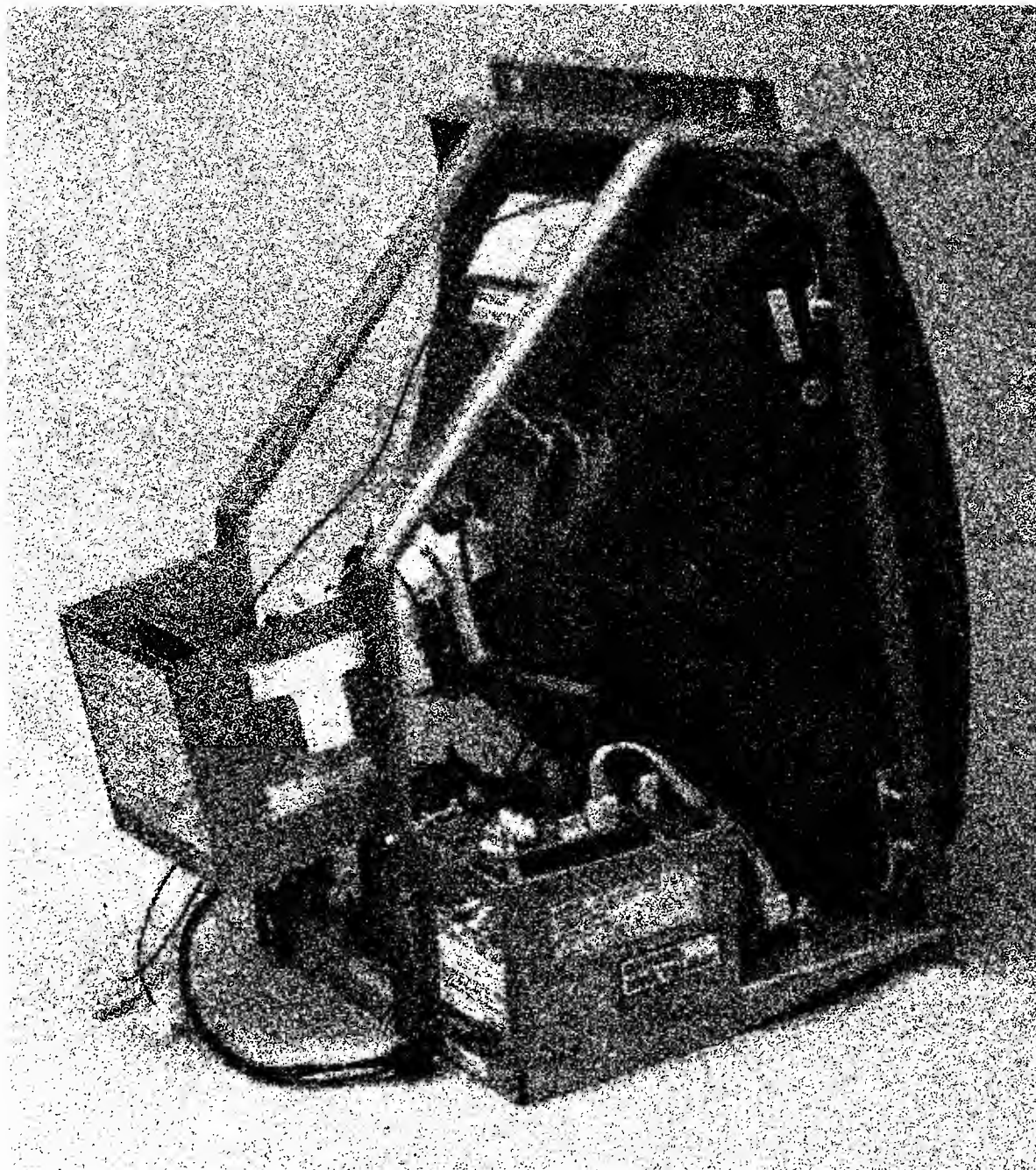


# Sanyo 19-Inch Color Raster Video Display

## Service Manual

With Schematic and Illustrated Parts List



Atari Games Corporation  
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Milpitas, California 95035

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## **For technical assistance:**

If reading through this manual does not lead to solving a maintenance or repair problem, call TELEHELP® at one of these Atari Games Customer Service offices:

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# 1 Warnings and Cautions

## Introduction

This display is contained within a separate chassis inside the game cabinet. The Main Chassis printed-circuit board (PCB) is mounted to the display chassis under the video tube, the Control PCB is located next to the Main Chassis PCB, and the Picture Tube Socket PCB is attached to the neck pins of the video tube. Input signals for the display are supplied through a 6-pin harness connector to the Signal Inversion PCB, then from that board to the Main Chassis PCB. (See Figure 1.)

## Before You Start

Never attempt to work on a display until you are familiar with servicing precautions and procedures necessary for high-voltage equipment. Remember, any video display has three sources of possible danger:

- Strong electric shock, due to high voltage or AC line voltage
- X-ray radiation
- Implosion

Therefore, never modify any circuit in this display.

Do not service this video display until you are thoroughly familiar with all warnings and safety measures given in this chapter.

### **WARNING**

#### **High Voltage**

This display contains high voltages capable of delivering lethal quantities of energy. To avoid danger, do not attempt to service the chassis until you have observed all precautions necessary for working on high-voltage equipment.

#### **X-Radiation**

This chassis has been designed for minimum X-radiation hazard. However, to avoid possible exposure to soft X-radiation, it is imperative that you never modify the high-voltage circuitry.

#### **Implosion Hazard**

If you drop the display and the picture tube breaks, it will implode! Shattered glass and the yoke can fly 6 feet or more from the implosion. Use care when replacing any display.

## Safety Measures

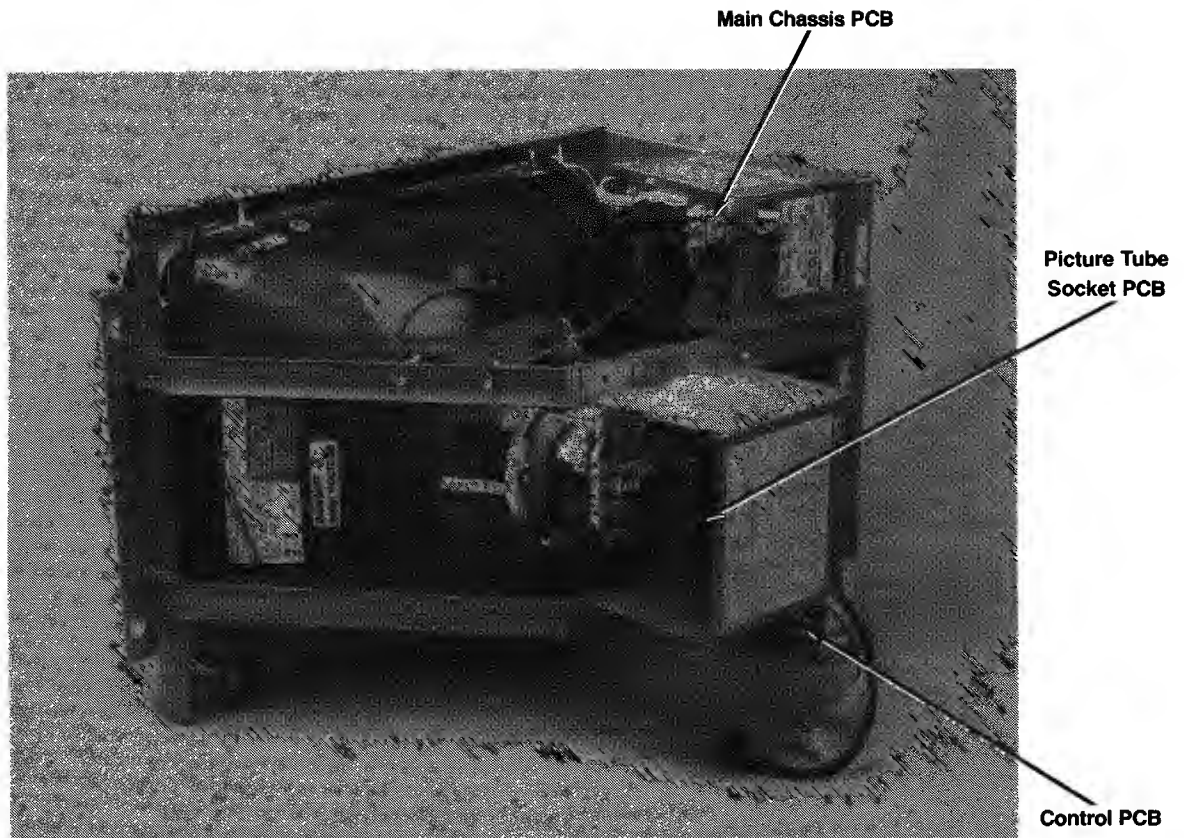
Good safety habits will allow you to automatically take the proper precautions, even if you are rushed. Whenever you work on a display, always ground the chassis first. Also, use only one hand. This avoids the possibility of carelessly putting one hand on the chassis or ground and the other on an electrical connection. Doing so could cause a severe electrical shock.

If you service the Sanyo Color Raster Display on a test bench, use only the power supply that came with the game or a 100 VAC isolation transformer. (Refer to the parts list in the game manual for the Atari part number of the power supply assembly.) Do not use line voltage because the voltage produced by this source will damage this display.

To prevent fire or shock hazard, never expose this display to moisture.

Periodically check for frayed insulation on the wires within the display. If frayed wires are found, replace them with the same gauge and length of wire. Always observe the original lead dress (routing and length of harness wires).

Use extra precaution in the high-voltage circuitry areas of the display. If a short circuit occurs, replace any components that indicate they may have overheated.



**Figure 1 Overview of Sanyo 19-Inch Color Raster Display**

## Cathode-Ray Tube Handling

Wear safety goggles and heavy gloves for protection whenever you handle a cathode-ray tube (CRT). Keep other people away if they are not wearing safety goggles. Never lift the CRT by the neck; the neck should only be used to guide the lifting process.

Use extreme care when handling the CRT. Rough handling may cause the CRT tube to implode. Do not nick or scratch the glass or subject any undue pressure upon the tube at any time.

If servicing the CRT, first discharge the high voltage on the anode connection to chassis ground—not to the cabinet or other mounting parts. See Chapter 5, step 3 of the Cathode-Ray Tube Replacement procedure to discharge the high voltage.

## Replace with Proper Components

Maintain the specified values of all components within the display. Failure to do so could cause a rise in the high voltage.

The cathode-ray tube of this display employs integral implosion protection. For continued safety, replace it only with a tube of the same type number. Refer to the parts lists in Chapter 7 of this manual. **For continued product safety, use only exact replacement parts**, especially for those parts identified in the parts lists with the ⚠ symbol and on the schematics with shading.

## Final Testing Before Reinstalling Display

Before reinstalling this color display into the game, you must check the following:

1. Inspect all harness wiring within the display area. Be sure no wires or cables are pinched between the cabinet and other parts in the display.
2. Replace all protective devices such as insulating fish paper, compartment covers, and shields.

# 2 Specifications

## Power Input and Consumption

Line Voltage	100 VAC, within +10% and -15%
Line Frequency	47 to 63 Hz
Power Consumption	74 W maximum

## Temperature and Humidity

### Ambient Air Temperature:

Operating	0°C to +55°C (+32°F to +130°F)
Non-operating	-40°C to +65°C (-40°F to +149°F)
Humidity	10% to 90%, non-condensing

## Current and Voltages

CRT Anode Current (Average)	Less than 650 $\mu$ A
High Voltage	24 kV $\pm$ 1.5 kV

## CRT Specifications

### Convergence Tolerance:

At Screen Center	0.010 inch (0.25 mm) maximum misconvergence
------------------	---

At Screen Edges	0.020 inch (0.5 mm) maximum misconvergence
Color Purity	Practically uniform throughout the screen area after degaussing with a hand-held degaussing coil.

### Scan Rates:

Horizontal	15.75 kHz, within $\pm$ 500 Hz
Vertical	60 Hz, within $\pm$ 5 Hz
CRT Type	510UTB22, 19-inch, 90°
Tilt of Deflection Yoke	Declination of a horizontal line is within 0.10 inch (2.54 mm).

## Connectors

### 6-Pin Connector for Video Signals:

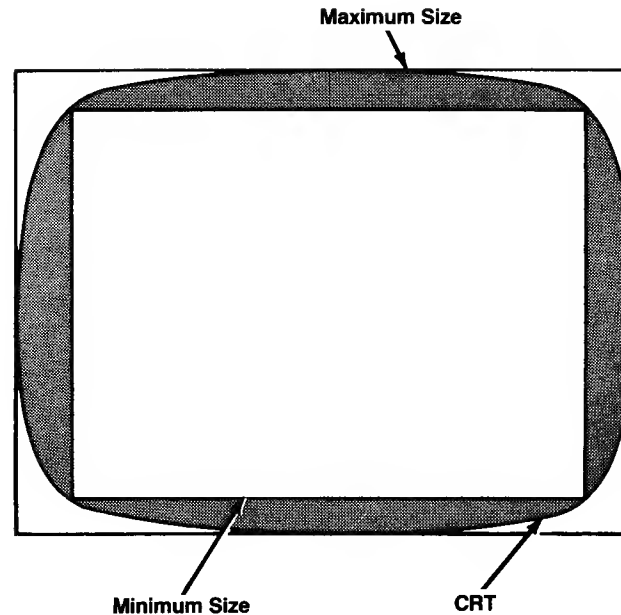
Pin 1	Green
Pin 2	Red
Pin 3	Blue
Pin 4	Ground
Pin 5	Ground
Pin 6	Negative Composite Sync

### 3-Pin Connector for Power:

Pin 1	100 VAC
Pin 2	No Connection
Pin 3	Neutral

## Pattern Size

You should be able to reproduce the patterns as shown in Figure 2.



**Figure 2 Display Pattern Sizes**

## 3 Control Adjustments

### **⚠ WARNING ⚠**

Remember to observe the precautions regarding high voltages when making adjustments to this display!

### **NOTE**

Too high a brightness level will cause the retrace lines to show; too low a level will cause the entire screen to be dark and obscure.

### **NOTE**

Before making any of the following adjustments, turn on the display and allow it to warm up for at least 5 minutes.

3. If the proper level of brightness cannot be obtained by adjusting the Brightness control, adjust the SUB-BRIGHT control VR301 as follows:
  - a. Set the game to display the self-test diagnostic pattern showing a white crosshatch. (Refer to the Self-Test chapter in the game manual for details on selecting this pattern.)
  - b. Attach an oscilloscope probe to each collector of the video amplifiers TR251, TR252, and TR253 and observe the blanking pulse waveform of each amplifier. The one with the most deflection of the blanking pulse is the lead gun.
  - c. Adjust the Sub-Brightness control so that the waveform is similar to the one shown in Figure 4.

### **Brightness**

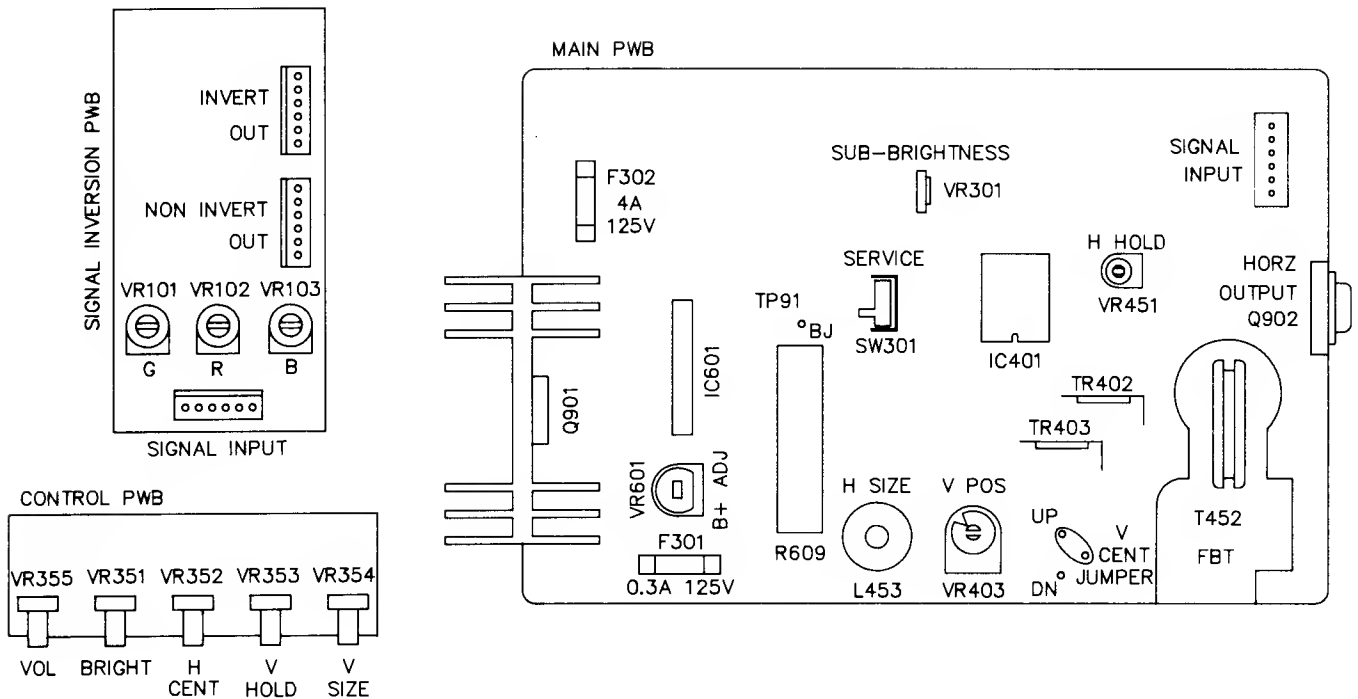
The BRIGHT control VR351 should be adjusted if the picture image is either too bright or too dark. See Figure 3 for the location of the Brightness control on the Control Printed-Circuit Board (PCB).

1. Place the game in the attract or play mode.
2. Using the Brightness control, adjust the display for a pleasing level of brightness.

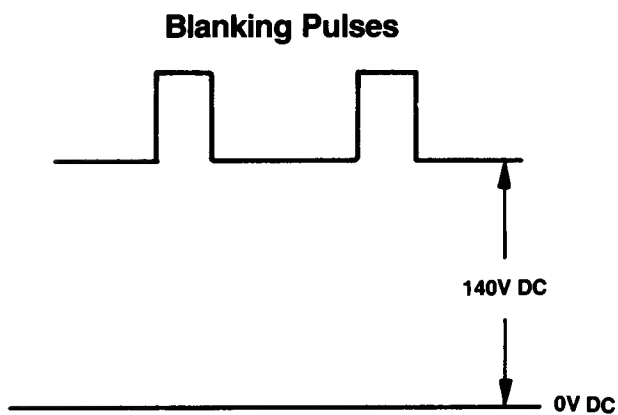
### **Tracking**

The Screen, Brightness, the three Bias, and two Drive controls should be adjusted if the picture image is not the correct

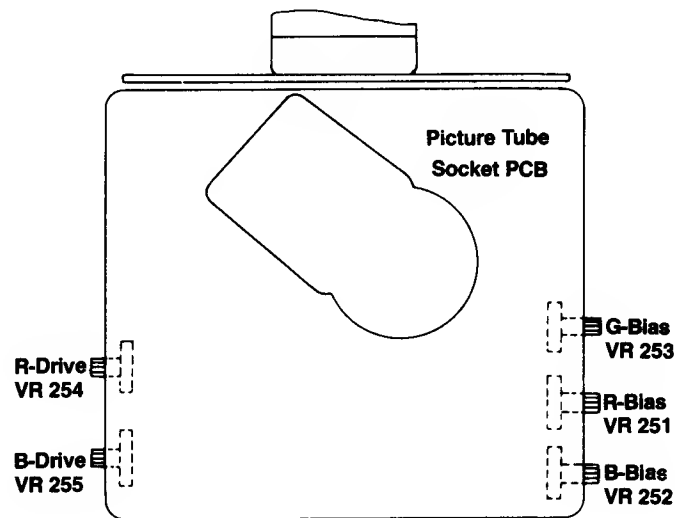




**Figure 3 Adjustable Controls and Test Points on Main Chassis PCB, Control PCB, and Signal Inversion PCB**



**Figure 4 Blanking Pulse Waveform of Video Amplifiers**



**Figure 5 Adjustable Controls on Picture Tube Socket PCB**

color or brightness, and whenever the purity and convergence is adjusted. (See Figure 3 for the location of the Screen and Brightness controls and Figure 5 for the Bias and Drive controls.)

1. Remove power from both the game and the display.
2. Unplug the 6-pin video-signal connector, which is wired to the Signal Inversion PCB.
3. Set the R-DRIVE control VR254 and the B-DRIVE control VR255 to their mechanical centers.
4. Set all three BIAS controls VR251, VR252, and VR253 to their mechanical centers.
5. Set the Brightness control to its mechanical center and the Screen control fully counterclockwise.
6. If the game has a self-test diagnostic pattern for the color purity test, set the game to display this test to complete the white tracking procedure. If the game does not have a color purity test, an RGB signal generator capable of producing a gray and a white raster is necessary.
7. Reconnect the 6-pin video-signal connector and apply power to the display.
8. Set the game to display the self-test diagnostic pattern showing the gray raster.
9. Slowly adjust the Screen control until the CRT screen displays the first hint of color. Do not adjust the Bias control for the color that first appeared on the screen. Instead, slowly adjust the Bias controls for the other two colors until the screen displays a faint gray color.
10. Set the game to display the self-test diagnostic pattern showing the white raster, and adjust the R-Drive and B-Drive controls for a uniform white. (Note: repeat steps 8 and 9 so that both the gray and white rasters have uniform color.)
11. Return the game to the attract mode. If necessary, adjust the Brightness control if the screen appears to be too dark or too bright.

## Horizontal Centering

The Horizontal Centering control should be adjusted if the picture is not centered on the screen, as indicated by a black area at either the left or the right edge. Figure 3 shows the location of the H-CENT control VR352 on the Control PCB. Adjust this control until a normal screen image is obtained.

## Vertical Hold

The Vertical Hold control should be adjusted if the picture drifts straight up or down on the screen. Figure 3 shows the

location of V-HOLD control VR353 on the Control PCB. Turn this control until the picture no longer drifts up or down on the screen.

## Vertical Size

The Vertical Size control should be adjusted if the screen image is either not filling the screen vertically, or if it is overscanning the screen vertically. Figure 3 shows the location of V-SIZE control VR354 on the Control PCB.

1. Set the game for the diagnostic test that displays the convergence grid and dots.
2. Adjust V-SIZE control until the top and bottom grid lines are along the top and bottom edges of the screen. These grid lines should not disappear off the edges of the screen, which would indicate overscanning.

## Horizontal Width

The Horizontal Width coil should be adjusted if the screen image is either too wide or narrow. Figure 3 shows the location of HORIZ WIDTH coil L453 on the Main Chassis PCB.

1. Set the game for the diagnostic test that displays the convergence grid and dots.
2. Use only a non-metallic Allen wrench (commonly called a "tweaking tool") to adjust the Horizontal Width coil until the right and left grid lines run along the edges of the screen. These grid lines should not disappear off the edges of the screen, which would indicate overscanning.

## Focus

The Focus control should be adjusted if the screen image is not sanely defined. The Focus control is attached to the top of the horizontal-output transformer as shown in Figure 3. Turn this control until you get optimum screen sanyness.

## Horizontal Hold

The Horizontal Hold control should be adjusted if the picture is drifting sideways across the screen. Figure 3 shows the location of H-HOLD control VR451 on the Main Chassis PCB. Adjust this control until the black lines no longer slant downward or upward and you get a normal screen image.

# 4 Signal Test Points

## RGB Signals

The red, green, and blue signals can be checked at the collectors of TR251 (Red), TR253 (Green), and TR252 (Blue). These transistors are located on the Picture Tube Socket PCB.

## Sync Signal

The negative composite synchronization (Sync) signal can be checked at pin 6 of the 6-pin video-signal connector, which is located off of the Signal Inversion PCB. Do not jam a test probe into the connector pin, because this may cause the pin to stretch and fall out of the connector housing.

# 5 Repair

### ⚠ WARNING ⚠

Before removing or installing any component of this display, always disconnect the power source! Observe the precautions regarding high voltages and cathode-ray tube handling when servicing this display.

### NOTE

The tools required to replace these assemblies include: 5/16-inch hex socket wrench, Phillips screwdriver, and a soldering iron.

6. Unplug the 4-wire connector attaching the yoke wires to the Main Chassis PCB.
7. Unhook the spring that holds the braided ground wire (located near the bottom corner of the CRT).
8. Use a  $\frac{5}{16}$ -inch hex socket wrench to remove the four screws holding the CRT to the steel frame.
9. CAREFULLY remove the CRT by easing it out the front of the chassis.
10. Place the CRT on a soft mat in a protected location.
11. Install a CRT in the reverse order of removal. Then adjust the SCREEN control G2 as follows:
  - a. Apply power to the display.
  - b. Turn the Brightness control on the Control PCB to the fully counterclockwise position.
  - c. Adjust the Screen control for a dimly-lighted screen. This control is attached to the horizontal-output transformer as shown in Figure 3.
  - d. Readjust the Brightness control as described in Chapter 3.

## Cathode-Ray Tube Replacement

1. Disconnect the 6-pin video-signal connector located off the Main Chassis PCB.
2. Remove the display assembly from the cabinet as described in the game manual.
3. Discharge the high voltage from the cathode-ray tube (CRT) as follows:
  - a. Attach one end of a well-insulated, 20 kV-resistive jumper to ground.
  - b. Briefly touch the free end of the resistive jumper to the anode by sliding it under the anode cap.
  - c. Wait two minutes.
  - d. Discharge the anode again.
  - e. *Carefully* remove the large high-voltage anode connector from the cathode-ray tube.
4. Unplug the Picture Tube Socket PCB from the rear of the tube.
5. Unplug the degaussing coil 2-pin connector from the Main Chassis PCB.

## Yoke Replacement

### NOTE

You must reconverge the picture whenever the yoke is replaced.

1. Disconnect the 6-pin video-signal connector located off the Signal Inversion PCB.
2. Remove the display assembly from the cabinet as described in the game manual.
3. Discharge the high voltage from the CRT as described in step 3 of *Cathode-Ray Tube Replacement*.

4. Unplug the Picture Tube Socket PCB from the rear of the CRT.
5. Use a thin knife or a single-edged razor blade and carefully loosen the three rubber wedges from the CRT surface.
6. Loosen the Phillips-head screws used to tighten the two neck clamps around the neck of the CRT.
7. Slide the magnet assembly and the yoke assembly off the end of the CRT.
8. Replace the yoke assembly in the reverse order of removal.
3. Discharge the high voltage from the CRT as described in step 3 of *Cathode-Ray Tube Replacement*.
4. Open the anode holder and remove the anode lead.
5. Unplug the Picture Tube Socket PCB at the rear of the CRT. Then unsolder the white wire on the Main Chassis PCB (goes to AO) and white wire (goes into the socket) on the Picture Tube Socket PCB.
6. Remove the Phillips-head screws that secure the metal cover over the transformer.
7. Remove the Phillips-head screw holding the metal bracket to the right side of the transformer.
8. Unsolder the 11 transformer connections on the bottom side of the Main Chassis PCB.
9. Lift the transformer off the Main Chassis PCB.
10. Replace the transformer in the reverse order of removal. Be sure to check the picture for sanyoness. If appropriate, readjust the Focus control as described in Chapter 3.

## Horizontal-Output Transformer Replacement

1. Disconnect the 6-pin video-signal connector located off the Main Chassis PCB.
2. Remove the display assembly from the cabinet as described in the game manual.

# 6 Adjustments

## ⚠ WARNING ⚠

Remember to observe the precautions regarding high voltages when making adjustments on this display!

Before adjusting the display, remove the display assembly from the cabinet as described in the game manual. Leave all cables connected between the display assembly and other parts of the game.

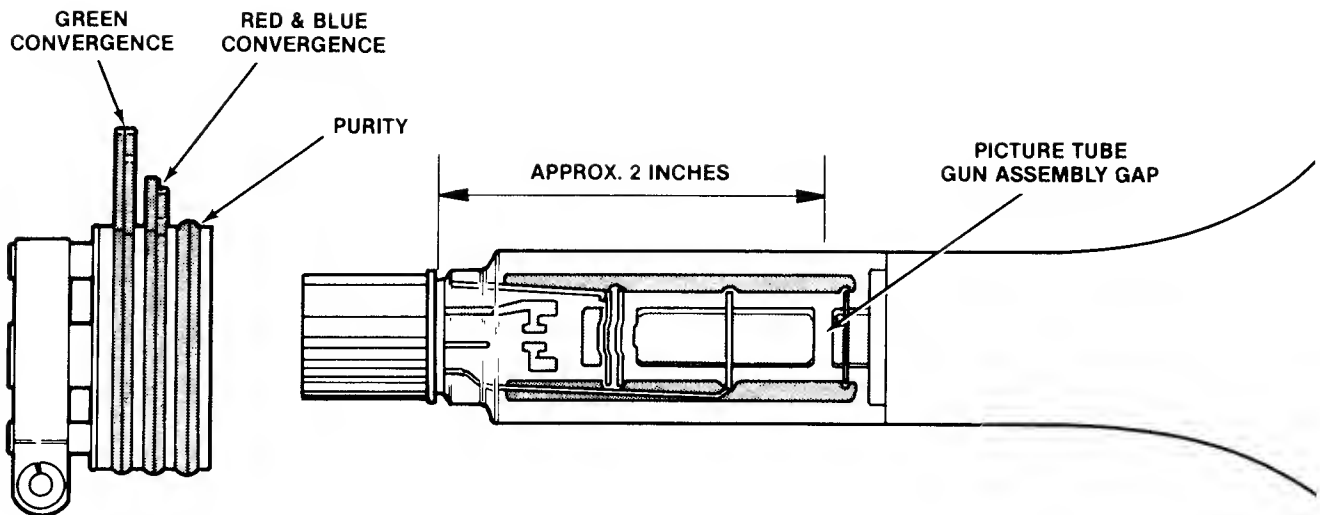
## Purity Adjustments

1. Set up the display for the purity adjustments as follows:
  - a. If you will also be adjusting the convergence of the outer screen area, loosen the mounting screws for both the deflection yoke and the magnet.
  - b. Position the cabinet so that the CRT faces either north or south.
  - c. Degauss the CRT tube with a hand-held degaussing coil.
2. Adjust for red purity as follows:
  - a. Turn off the green and blue guns of the CRT by rotating the G-BIAS VR253 and B-BIAS VR252 controls to the fully counterclockwise position. (See Figure 5 for the location of the Bias adjustments.)
  - b. Set the game to display any self-test diagnostic pattern that shows solid white. Keep this image throughout the purity adjustments. (Refer to the Self-Test chapter in the game manual for details on selecting this pattern.)
  - c. Rotate and spread the tabs of the purity magnets until the screen image is centered both horizontally and vertically. (See Figure 6.)
  - d. Readjust the purity magnets for a uniformly red screen. This may interact with the previous adjustment made in step 2c.
3. Adjust for green purity as follows:
  - a. Turn off the red and blue guns of the CRT by rotating the R-BIAS VR251 and B-BIAS VR252 controls to the fully counterclockwise position.
  - b. Readjust the purity magnets, if necessary, for a uniformly green screen. This may interact with the previous adjustment.
4. Adjust for blue purity as follows:

- a. Turn off the red and blue guns of the CRT by rotating the R-Bias and G-Bias controls to the fully counterclockwise position.
  - b. Readjust the purity magnets, if necessary, for a uniformly blue screen. This may interact with the previous adjustments.
5. Return the R-Bias, G-Bias, and B-Bias controls to their original settings. Check the screen for a pure white display that is not tinted with other hues.
  6. Reinstall the display in the game.
  7. Perform the convergence adjustments.

## Convergence Adjustments

1. Adjust for static convergence (screen center) as follows:
  - a. If you will also be converging the outer area of the picture, loosen the mounting screws for the deflection yoke and magnet, if not already done as part of the purity adjustments.
  - b. Set the game to display the self-test diagnostic pattern that shows a black background with white lines and dots. Keep this image on the display throughout all convergence adjustments.
  - c. Turn off the green gun of the CRT by rotating the G-Bias control to the fully counterclockwise position. Figure 4 shows the location of the Bias controls.
  - d. Adjust the angle of the center pair of magnets to superimpose the red and blue vertical lines in the center of the screen area. (See Figure 5.)
  - e. Keeping their angles the same, rotate both tabs of the center pair of magnets to superimpose the red and blue horizontal lines in the center of the screen area.
  - f. Turn on the green gun of the CRT by returning the G-Bias control to its original setting.
  - g. Adjust the angle of the rear pair of magnets shown in Figure 5 to superimpose the green vertical lines on the red and blue ones already in the center of the screen.
  - h. Keeping their angles the same, rotate both tabs of these magnets to superimpose the green horizontal lines on the red and blue ones in the center of the screen.
2. Adjust the dynamic convergence (outer screen) as follows:
  - a. Use a razor blade or thin knife and carefully loosen the glue holding the three rubber wedges beneath the yoke collar. Remove these wedges.



**Figure 6 Purity and Convergence Adjustments**

- b. Check that the mounting screws for the deflection yoke assembly and the magnet assembly are loosened.
- c. Slide the yoke slightly away from the CRT.
- d. Move the yoke until the outer lines and dots on the screen are pure white. The up/down movement of the yoke causes the outer edges of the screen image to swivel clockwise/counterclockwise. A side-to-side movement causes the lines and dots at the outer screen edges to expand and contract.
- e. Secure the deflection yoke in position by putting the wedges back between the CRT and the yoke collar.
- f. Secure the wedges with white glue.
- g. Tighten the mounting screws to secure the magnet and deflection yoke assemblies.

3. Perform the tracking adjustments in Chapter 3.

## B+ Adjustment

1. Set the Brightness control on the Control PCB for maximum brightness.
2. Set a DC voltmeter to the 0-volt to +150-volt range.
3. Connect the plus lead of the voltmeter to test point 91. (See Figure 3.)
4. Connect the minus lead of the voltmeter to ground.
5. Adjust VR601 located near the DC fuse on the Main Chassis PCB for a voltmeter reading of +108 V.
6. Return the Brightness control to its normal setting.

## Sanyo Models 20-Z2AW & 20-EZV Video Display

### Atari Part Number 139021-002/003

### Parts List

#### NOTE

These video displays contain circuits and components included specifically for safety purposes. The ▲ symbol is used in the parts list to mark safety-critical components that you should replace only with exact factory replacement parts. Using substitute parts may create a shock, fire, radiation, or other hazard. Only qualified personnel should service these video displays.

Designator	Description	Part No.
<b>Printed-Circuit Board Assemblies</b>		
▲	Assembly, Main PCB (Model 20-Z2AW only)	99-160640
▲	Assembly, Main PCB (Model 20-EZV only)	99-160639
▲	Assembly, CRT PCB	99-160642
▲	Assembly, Control PCB	99-160641
▲	Assembly, Signal Inversion PCB	99-160643
<b>Capacitors</b>		
C161, C202	Capacitor, Electrolytic, 220 $\mu$ F, 16 V	99-160303
C162, C411	Capacitor, Electrolytic, 4.7 $\mu$ F, 25 V	99-160306
C164, C402	Capacitor, Mylar, .015 $\mu$ F, 50 V	99-160487
C165	Capacitor, Mylar, 2700 $\mu$ F, 50 V	99-160486
C166, C302, C453, C454	Capacitor, Electrolytic, 1.0 $\mu$ F, 50 V	99-160307
C201, C301, C303, C406	Capacitor, Electrolytic, 10 $\mu$ F, 50 V	99-160623
C203, C305, C452	Capacitor, Ceramic, .01 $\mu$ F, 50 V	99-160314
C251-253	Capacitor, Ceramic, 150 pF, 50 V	99-160471
C257, C258	Capacitor, Ceramic, 1000 pF, 1000 V	99-160337
C401	Capacitor, Mylar, .068 $\mu$ F, 50 V	99-160332
C403	Capacitor, Mylar, 0.33 $\mu$ F, 50 V	99-160492
C404	Capacitor, Mylar, .056 $\mu$ F, 50 V	99-160488
C407	Capacitor, Electrolytic, 10 $\mu$ F, 160 V	99-160498
C408, C467, C610	Capacitor, Electrolytic, 1.0 $\mu$ F, 160 V	99-160624
C410, C472	Capacitor, Electrolytic, 100 $\mu$ F, 160 V	99-160310
C412	Capacitor, Mylar, 0.082 $\mu$ F, 50 V	99-160328
C451, C460	Capacitor, Poly Film, 8200 pF, 50 V	99-160661
C455	Capacitor, Polypropylene, 2200 $\mu$ F, 630 V	99-160496
C458	Capacitor, Electrolytic, 47 $\mu$ F, 10 V	99-160586
C459	Capacitor, Electrolytic, 100 $\mu$ F, 16 V	99-160302
C461	Capacitor, Ceramic, 4700 pF, 500 V	99-160323
C462	Capacitor, Ceramic, 470 pF, 500 V	99-160322
C464	Capacitor, Electrolytic, 22 $\mu$ F, 50 V	99-160489
C465, C466	Capacitor, Ceramic, 820 pF, 500 V	99-160324
C468	Capacitor, Electrolytic, 330 $\mu$ F, 25 V	99-160588
C469	Capacitor, Electrolytic, 220 $\mu$ F, 25 V	99-160587
C470	Capacitor, Polypropylene, 0.47 $\mu$ F, 200 V	99-160494
C471	Capacitor, Electrolytic, 10 $\mu$ F, 160 V	99-160309

## Sanyo Models 20-Z2AW & 20-EZV Video Display Parts List, Continued

Designator	Description	Part No.
C473 ▲	Capacitor, Polypropylene, 6800 pF, 2000 V	99-160665
C474	Capacitor, Ceramic, 500 pF, 2000 V	99-160327
C475 ▲	Capacitor, Ceramic, 200 pF, 2000 V	99-160585
C482	Capacitor, Ceramic, 5.0 pF, 50 V	99-160584
C485	Capacitor, Mylar, .047 $\mu$ F, 50 V	99-160319
C486	Capacitor, Mylar, 2700 pF, 50 V	99-160491
C601 ▲	Capacitor, Electrolytic, N-P, .056 $\mu$ F, 125V	99-160664
C602-605 ▲	Capacitor, Ceramic, 1000 pF, 1000 V	99-160325
C606	Capacitor, Electrolytic, 470 $\mu$ F, 160 V	99-160660
C607	Capacitor, Mylar, .1 $\mu$ F, 50 V	99-160485
C609	Capacitor, Electrolytic, 470 $\mu$ F, 10 V	99-160300
C611	Capacitor, Polypropylene, 0.022 $\mu$ F, 200 V	99-160495
<b>Diodes</b>		
D161, D202-207, D211, D212, D302, D303, D401, D403 D201	Diode, 1S1555  Diode, Zener, EQA01-07S	99-160106  99-160581
D210	Diode, Zener, EQA01-12	99-160666
D301	Diode, 1S1801-02	99-160100
D405-D406	Diode, 1S188TV	99-160619
D451 ▲	Diode, Zener, EQA01-12R1A	99-160503
D452 ▲	Diode, 1S1553	99-160576
D453	Diode, EU-1	99-160657
D454, D457	Diode, RU2	99-160102
D601-D604 ▲	Diode, ERC04-06	99-160104
<b>Integrated Circuits</b>		
IC401	IC, Sync Separator, LA1464	99-160007
IC601 ▲	IC, Voltage Regulator, LA5112R	99-160658
<b>Thermistors</b>		
TH301	Thermistor, SDT-500	99-160202
TH401	Thermistor, SDT-1000	99-160502
<b>Transistors</b>		
TR204-208, TR210, TR211	Transistor, NPN, 2SC536NP	99-160015
TR251-TR253	Transistor, NPN, 2SC1507	99-160018
TR301	Transistor, NPN, 2SC536	99-160513
TR302	Transistor, PNP, 2SA659	99-160016
TR401	Transistor, NPN, 2SC2551	99-160580
TR402	Transistor, NPN, 2SC2073R	99-160578
TR403	Transistor, PNP, 2SA940R	99-160579
TR451	Transistor, NPN, 2SC2271M	99-160017
TR901 ▲	Transistor, NPN, 2SD1090	99-160469
TR902 ▲	Transistor, NPN, 2SD869	99-160465
<b>Resistors</b>		
R161	Resistor, Carbon, 120 $\Omega$ , $\frac{1}{2}$ W	99-160522
R162	Resistor, Carbon, 2.2 k $\Omega$ , $\frac{1}{4}$ W	99-160673
R164, R308	Resistor, Carbon, 220 $\Omega$ , $\frac{1}{4}$ W	99-160481
R165 ▲	Resistor, Carbon, 1.0 k $\Omega$ , $\frac{1}{4}$ W	99-160548

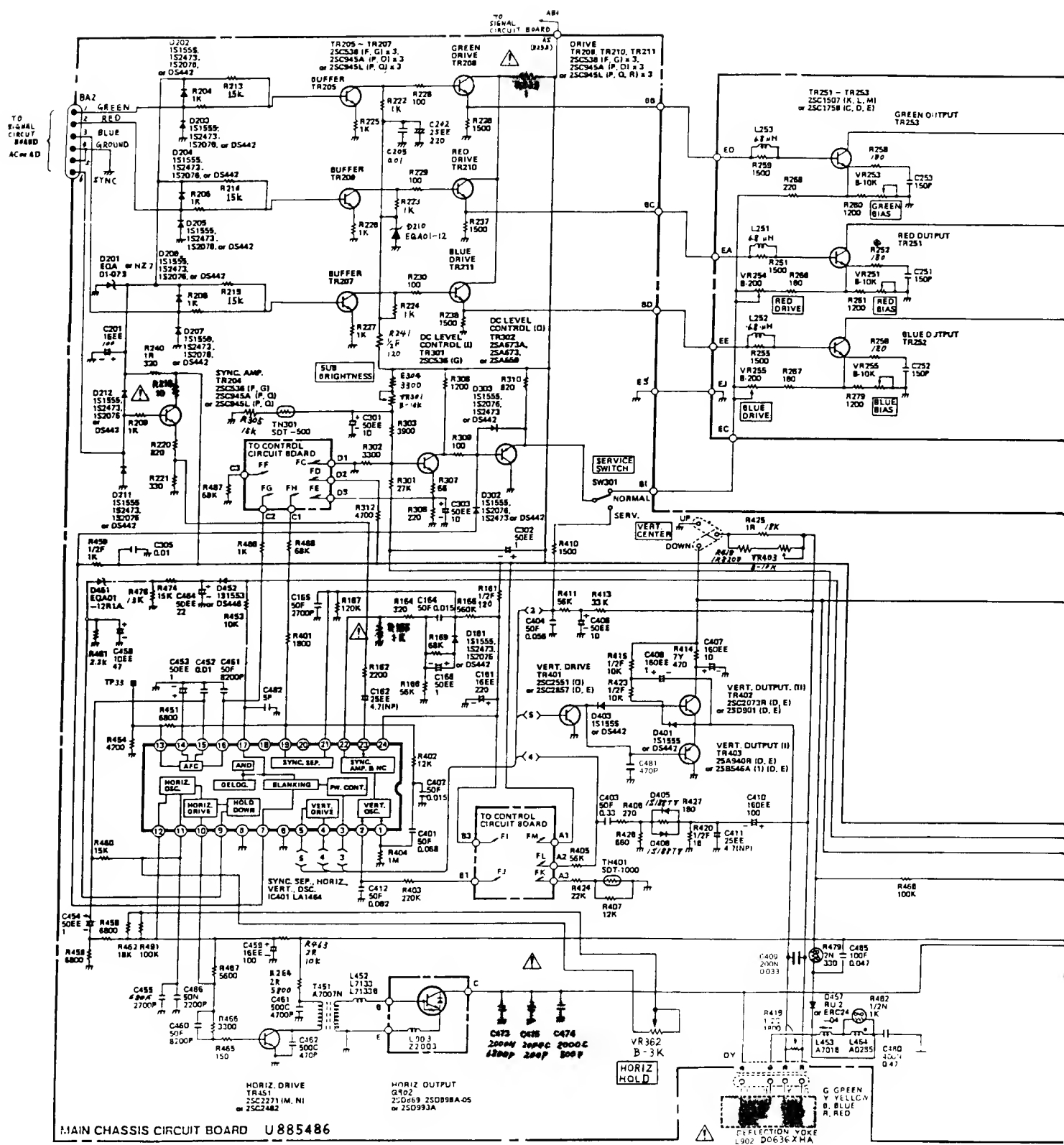


## Sanyo Models 20-Z2AW & 20-EZV Video Display Parts List, Continued

Designator	Description	Part No.
R166	Resistor, Carbon, 560 k $\Omega$ , $\frac{1}{4}$ W	99-160516
R167, R602, R603	Resistor, Carbon, 120 k $\Omega$ , $\frac{1}{4}$ W	99-160561
R168, R405, R411	Resistor, Carbon, 56 k $\Omega$ , $\frac{1}{4}$ W	99-160515
R169, R487, R488	Resistor, Carbon, 68 k $\Omega$ , $\frac{1}{4}$ W	99-160520
R216 ▲	Resistor, Carbon, 10 $\Omega$ , $\frac{1}{4}$ W	99-160547
R204–R206, R209, R225–R227, R486, R489, R222–R224	Resistor, Carbon, 1.0 k $\Omega$ , $\frac{1}{4}$ W	99-160556
R213–R215, R305, R460	Resistor, Carbon, 15 k $\Omega$ , $\frac{1}{4}$ W	99-160563
R220, R310	Resistor, Carbon, 820 $\Omega$ , $\frac{1}{4}$ W	99-160521
R221	Resistor, Carbon, 330 $\Omega$ , $\frac{1}{4}$ W	99-160570
R228–R230, R309	Resistor, Carbon, 100 $\Omega$ , $\frac{1}{4}$ W	99-160555
R231, R255, R259	Resistor, Carbon, 1.5 k $\Omega$ , $\frac{1}{4}$ W	99-160480
R236–R238, R410	Resistor, Carbon, 1.5 k $\Omega$ , $\frac{1}{4}$ W	99-160480
R239, R473, R478 ▲	Resistor, Carbon, 1.0 $\Omega$ , $\frac{1}{4}$ W	99-160546
R240	Resistor, Metal Oxide, 330 $\Omega$ , 1 W	99-160534
R252, R256, R260, R266, R267	Resistor, Carbon, 180 $\Omega$ , $\frac{1}{4}$ W	99-160564
R253, R257, R261	Resistor, Metal Oxide, 5.6 k $\Omega$ , 1 W	99-160483
R263–R265	Resistor, Carbon, 1.0 k $\Omega$ , $\frac{1}{2}$ W	99-160476
R273	Resistor, Metal Oxide, 0.39 $\Omega$ , 1 W	99-160482
R274	Resistor, Carbon, 100 k $\Omega$ , $\frac{1}{2}$ W	99-160477
R279–281	Resistor, Carbon, 1.2 k $\Omega$ , $\frac{1}{4}$ W	99-160479
R301	Resistor, Carbon, 27 k $\Omega$ , $\frac{1}{4}$ W	99-160569
R302, R304, R466	Resistor, Carbon, 3.3 k $\Omega$ , $\frac{1}{4}$ W	99-160571
R303, R608	Resistor, Metal Oxide, 3.9 k $\Omega$ , $\frac{1}{4}$ W	99-160573
R306	Resistor, Carbon, 1.2 k $\Omega$ , $\frac{1}{4}$ W	99-160479
R307	Resistor, Carbon, 68 $\Omega$ , $\frac{1}{4}$ W	99-160517
R312, R454	Resistor, Carbon, 4.7 k $\Omega$ , $\frac{1}{4}$ W	99-160574
R401	Resistor, Carbon, 1.8 k $\Omega$ , $\frac{1}{4}$ W	99-160565
R402, R407	Resistor, Carbon, 12 k $\Omega$ , $\frac{1}{4}$ W	99-160560
R403	Resistor, Carbon, 220 k $\Omega$ , $\frac{1}{4}$ W	99-160567
R404	Resistor, Carbon, 1.0 m $\Omega$ , $\frac{1}{4}$ W	99-160559
R408	Resistor, Carbon, 270 $\Omega$ , $\frac{1}{4}$ W	99-160568
R413	Resistor, Carbon, 33 k $\Omega$ , $\frac{1}{4}$ W	99-160572
R414	Resistor, Wire Wound, 470 $\Omega$ , 7 W	99-160542
R415, R423	Resistor, Carbon, 10 k $\Omega$ , $\frac{1}{2}$ W	99-160524
R418	Resistor, Metal Oxide, 8.2 k $\Omega$ , 1 W	99-160620
R419	Resistor, Carbon, 18 k $\Omega$ , $\frac{1}{2}$ W	99-160670
R420	Resistor, Carbon, 18 $\Omega$ , $\frac{1}{2}$ W	99-160525
R421, R455 ▲	Resistor, Carbon, 1 k $\Omega$ , $\frac{1}{2}$ W	99-160523
R421	Resistor, Carbon, 120 $\Omega$ , $\frac{1}{2}$ W (Model EZV only)	99-160674
R424	Resistor, Carbon, 22 k $\Omega$ , $\frac{1}{4}$ W	99-160566
R425	Resistor, Metal Oxide, 18 k $\Omega$ , 1 W	99-160533
R426	Resistor, Carbon, 680 $\Omega$ , $\frac{1}{4}$ W	99-160518
R427	Resistor, Carbon, 180 $\Omega$ , $\frac{1}{4}$ W	99-160564
R451, R458, R459	Resistor, Carbon, 6.8 k $\Omega$ , $\frac{1}{4}$ W	99-160519
R461, R476 ▲	Resistor, Carbon, 11 k $\Omega$ , $\frac{1}{4}$ W (Model Z2AW only)	99-160679
R461	Resistor, Carbon, 2.2 k $\Omega$ , $\frac{1}{4}$ W	99-160672
R462	Resistor, Carbon, 18 k $\Omega$ , $\frac{1}{4}$ W	99-160553

## Sanyo Models 20-Z2AW & 20-EZV Video Display Parts List, Continued

Designator	Description	Part No.
R463	Resistor, Metal Oxide, 10 k $\Omega$ , 2 W	99-160675
R464	Resistor, Metal Oxide, 5.8 k $\Omega$ , 2 W (Model EZV only)	99-160675
R464	Resistor, Metal Oxide, 6.8 k $\Omega$ , 2 W (Model Z2AW only)	99-160678
R465	Resistor, Carbon, 150 $\Omega$ , ¼ W	99-160562
R467	Resistor, Carbon, 5.6 k $\Omega$ , ¼ W	99-160514
R470	Resistor, Metal Oxide, 1.0 k $\Omega$ , 1 W	99-160532
R471, R453, R606, R607	Resistor, Carbon, 10 k $\Omega$ , ¼ W	99-160557
R472, R612 ▲	Resistor, Carbon, 33 $\Omega$ , ¼ W	99-160549
R474 ▲	Resistor, Carbon, 15 k $\Omega$ , ¼ W	99-160551
R476	Resistor, Carbon, 13 k $\Omega$ , ¼ W	99-160671
R477 ▲	Resistor, Metal Film, 3.3 $\Omega$ , 1 W	99-160530
R479 ▲	Resistor, Metal Film, 330 $\Omega$ , 2 W	99-160531
R482 ▲	Resistor, Metal Film, 1.0 k $\Omega$ , ½ W	99-160523
R601 ▲	Resistor, Wire Wound, 1.5 $\Omega$ , 7 W	99-160677
R604	Resistor, Metal Oxide, 1.2 k $\Omega$ , 3 W	99-160211
R605 ▲	Resistor, Carbon, 39 k $\Omega$ , ½ W	99-160526
R608	Resistor, Metal Oxide, 5.6 k $\Omega$ , ¼ W (Model EZV only)	99-160514
R609	Resistor, Wire Wound, 180 $\Omega$ , 20 W	99-160676
R611 ▲	Resistor, Carbon, 330 $\Omega$ , ¼ W	99-160540
VR251–VR253, VR351	Potentiometer, Trimming, 10 k $\Omega$	99-160403
VR254, VR255	Potentiometer, Trimming, 200 $\Omega$	99-160404
VR301	Potentiometer, Trimming, 10 k $\Omega$	99-160662
VR352, VR253	Potentiometer, Trimming, 200 k $\Omega$	99-160401
VR354, VR355	Potentiometer, Trimming, 50 k $\Omega$	99-160402
VR403	Potentiometer, Trimming, 10 k $\Omega$	99-160511
VR451, VR362	Potentiometer, Trimming, 3 k $\Omega$	99-160510
VR601 ▲	Potentiometer, Trimming, 10 k $\Omega$	99-160406
<b>Transformers</b>		
T451	Transformer, Horiz, Drive	99-160010
T452 ▲	Transformer, Flyback (Model Z2AW only)	99-160508
T452 ▲	Transformer, Flyback (Model EZV only)	99-160669
T701	Transformer, Choke	99-213036
<b>Miscellaneous</b>		
F301 ▲	Fuse, DC, 125 V, 0.3 A	99-160668
F302 ▲	Fuse, AC, 125 V, 4 A	99-160667
L251–L253	Coil, Peaking, 6.8 $\mu$ H	99-160656
L452	Coil, Filter	99-160451
L453 ▲	Coil, Width	99-160663
L454 ▲	Coil, Linearity	99-160582
L601 ▲	Filter, Line	99-160659
L901 ▲	Coil, Degaussing (Model Z2AW only)	99-160637
L901	Coil, Degaussing (Model EZV only)	99-160638
L902 ▲	Yoke, Deflection	99-160635
L902 ▲	Yoke, Deflection	99-160636
Q902 ▲	CRT, 19" Color, Standard-Resolution 510UTB22	99-160632
K251 ▲	Socket, CRT	99-160472
SW301	Switch, Service	99-160504
▲	Magnets, Convergence/Purity	99-160459



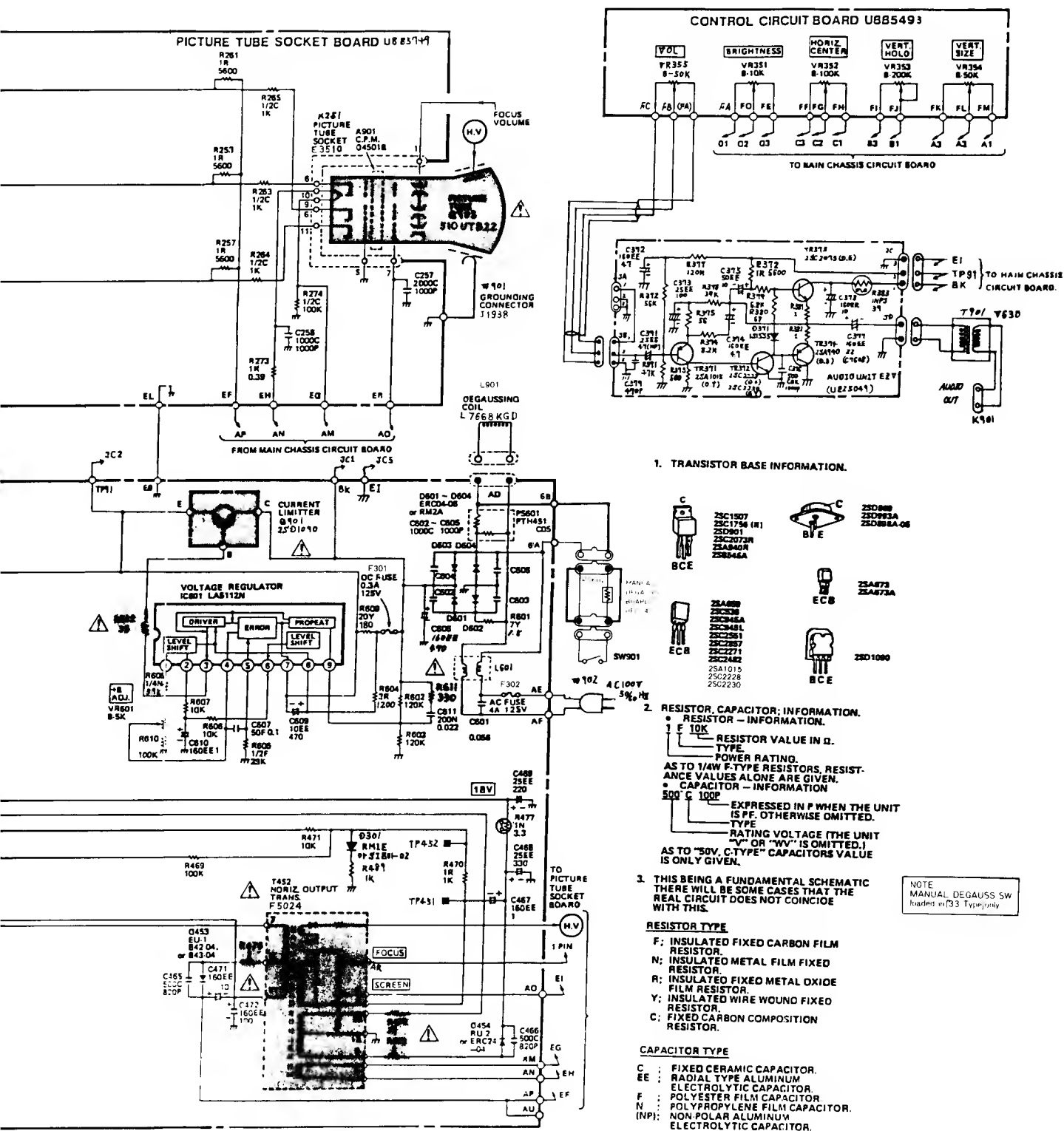
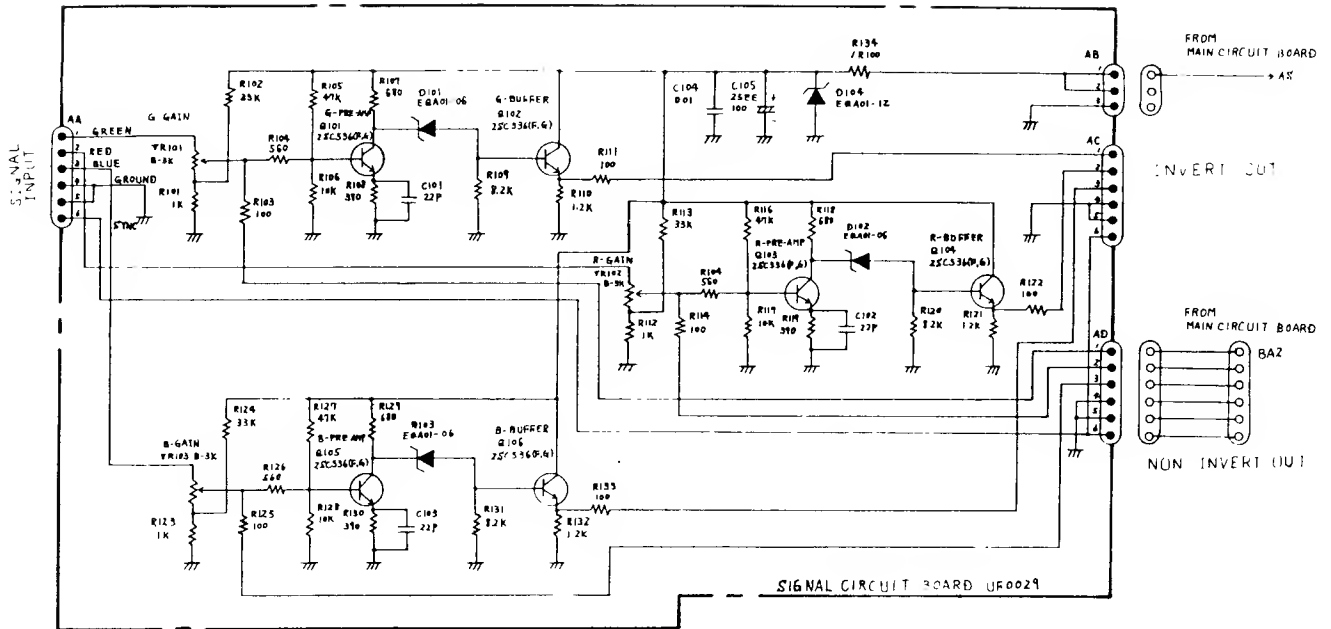


Figure 7 Sanyo Model 20-EZV Video Display Schematic Diagram, Sheet 1



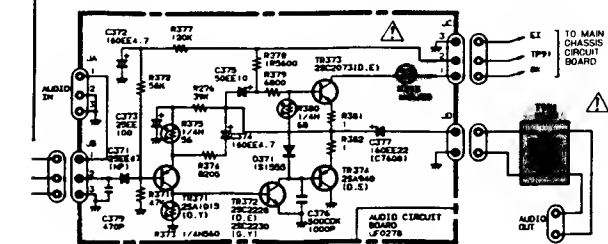
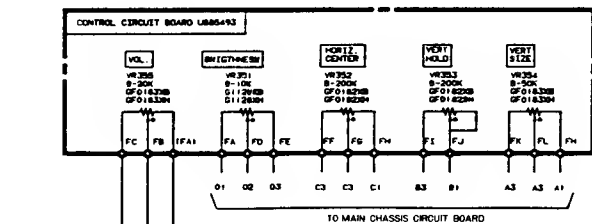
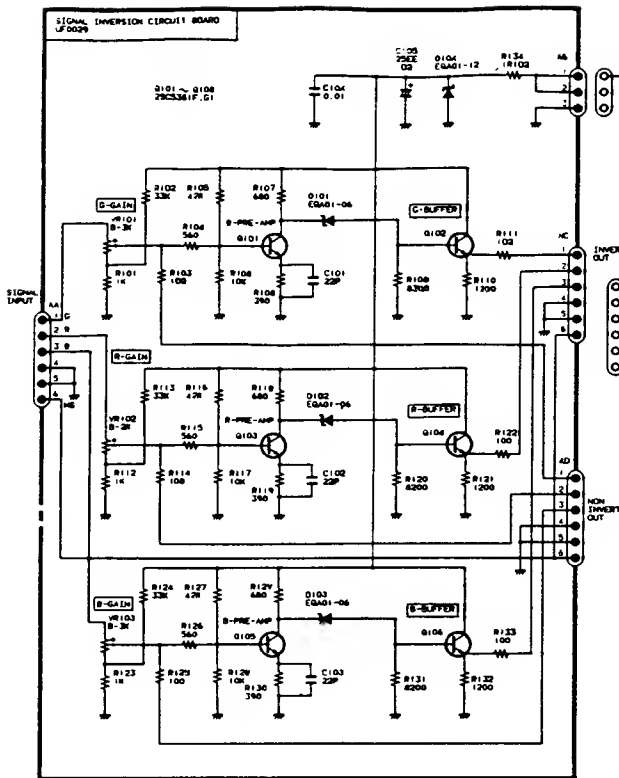
### ⚠ WARNING ⚠

This product contains critical electrical and mechanical parts essential for X-ray radiation protection. For continued protection, use only type parts shown in the parts list. The ⚠ symbol and the shaded areas on this schematic diagram indicate parts essential for X-ray radiation and safety protection.

Service work should only be performed by a qualified service technician.

Before servicing or testing this display, you must install an isolation transformer between the AC supply and the AC plug of the monitor. The chassis and the heat sink are directly connected to one side of the AC line, and therefore could present a shock hazard. The supply voltage of the video display is 90-110 V, 50/60 Hz.

**Figure 7 Sanyo Model 20-EZV Video Display Schematic Diagram, Sheet 2**

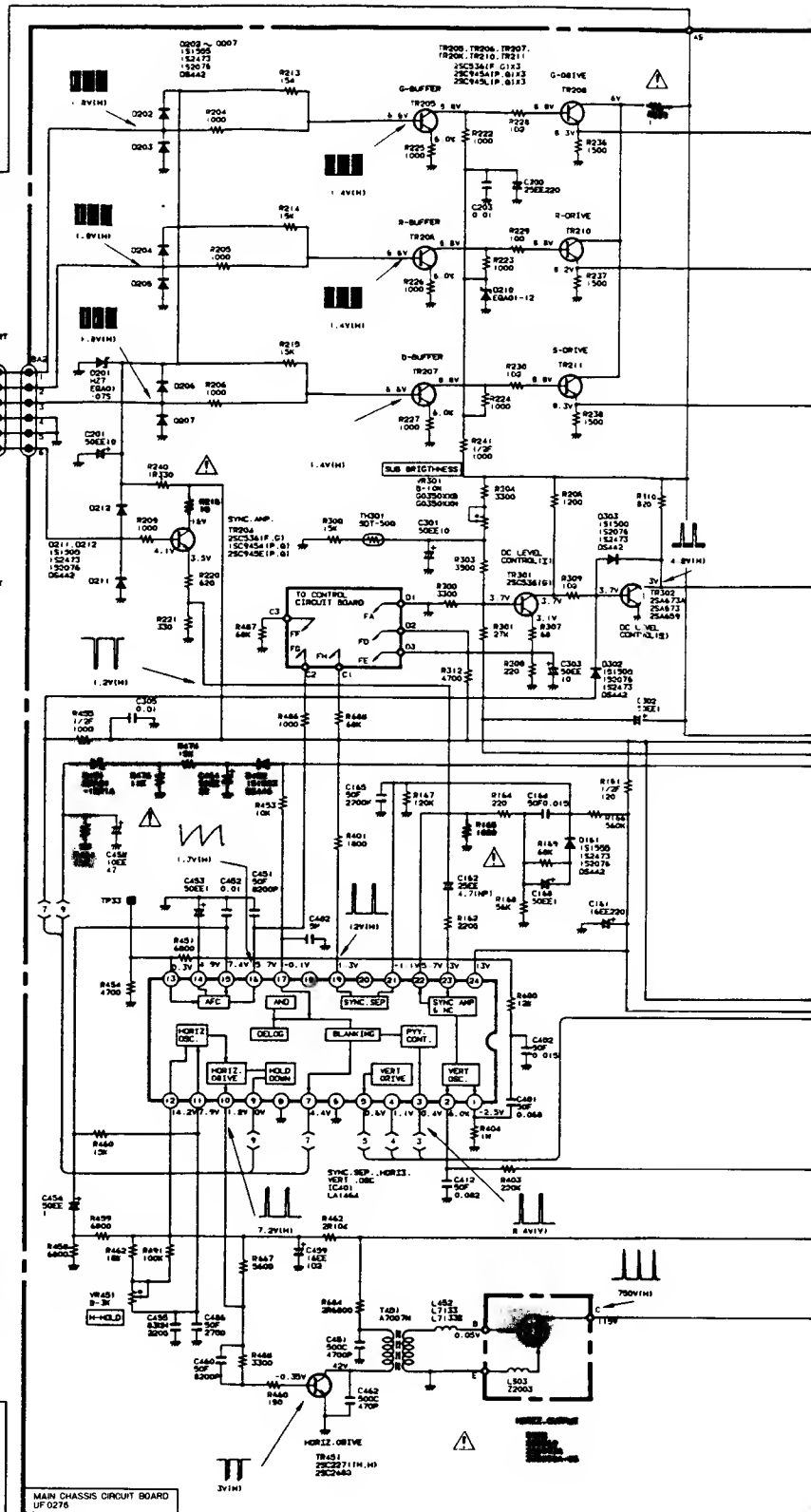


**⚠ WARNING ⚠**

This product contains critical electrical and mechanical parts essential for X-ray radiation protection. For continued protection, use only type parts shown in the parts list. The ▲ symbol and the shaded areas on this schematic diagram indicate parts essential for X-ray radiation and safety protection.

Service work should only be performed by a qualified service technician.

Before servicing or testing this display, you must install an isolation transformer between the AC supply and the AC plug of the monitor. The chassis and the heat sink are directly connected to one side of the AC line, and therefore could present a shock hazard. The supply voltage of the video display is 90–110 V, 50/60 Hz.



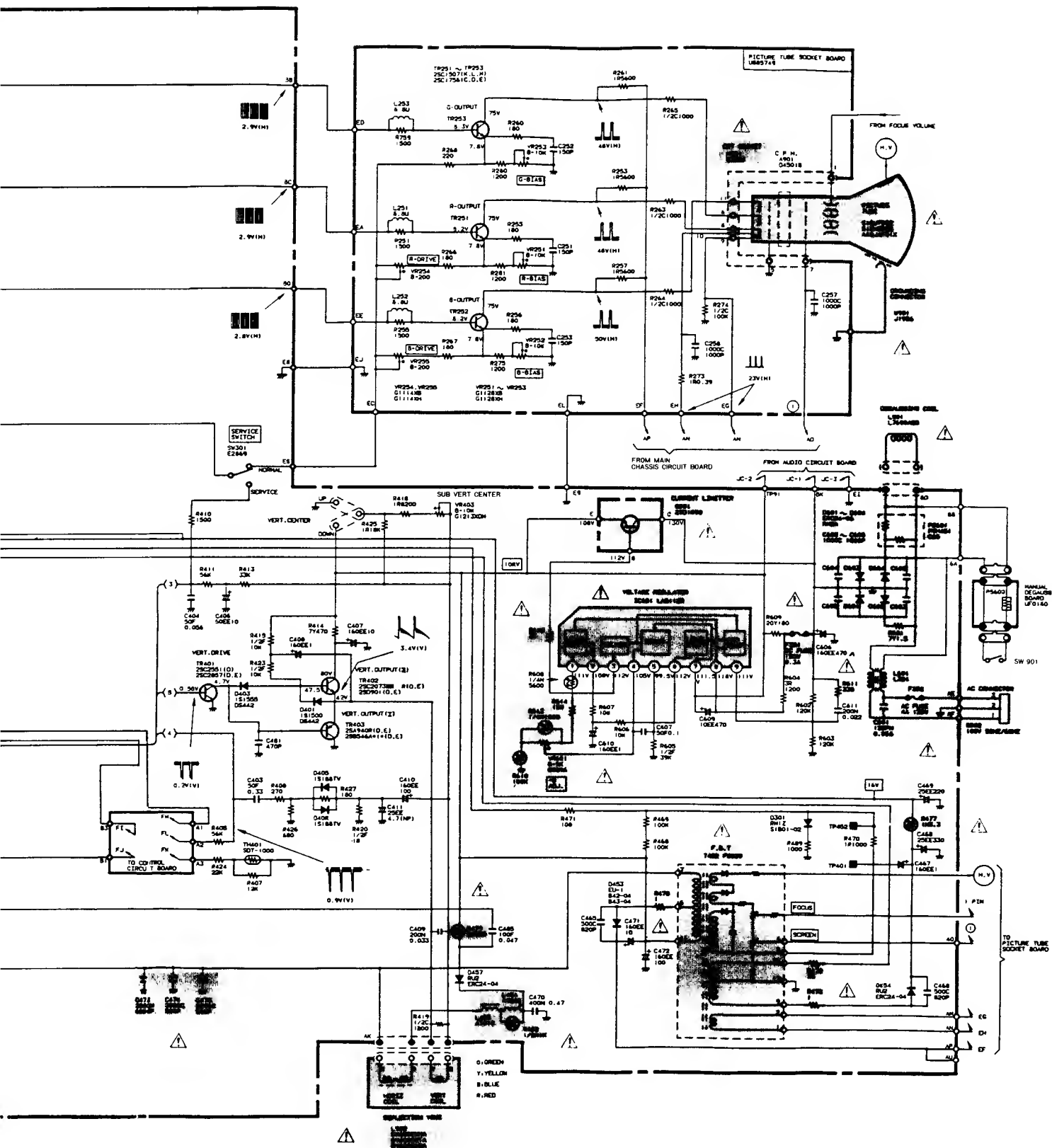


Figure 8 Sanyo Model 20-Z2AW Video Display Schematic Diagram

# Warranty

Seller warrants that its printed-circuit boards and parts thereon are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from date of shipment. Seller warrants that its video displays and laser video disc players (in games supplied with displays and video-disc players) are free from defects in material and workmanship under normal use and service for a period of thirty (30) days from date of shipment. None of the Seller's other products or parts thereof are warranted.

If the products described in this manual fail to conform to this warranty, Seller's sole liability shall be, at its option, to repair, replace, or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

- (a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;
- (b) Such products are returned prepaid to Seller's plant; and
- (c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident, misuse, neglect, alteration, improper repair, installation, or improper testing.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

*Except for any express warranty set forth in a written contract between Seller and Buyer which contract supersedes the terms herein, this warranty is expressed in lieu of all other warranties expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose, and of all other obligations or liabilities on the Seller's part, and it neither assumes nor authorizes any other person to assume for the Seller any other liabilities in connection with the sale of products by Seller.*

The use of any non-Atari parts may void your warranty, according to the terms of the warranty. The use of any non-Atari parts may also adversely affect the safety of your game and cause injury to you and others. Be very cautious in using non-Atari-supplied components with our games, in order to ensure your safety.

Atari distributors are independent, being privately owned and operated. In their judgment they may sell parts or accessories other than Atari parts or accessories. Atari Games Corporation cannot be responsible for the quality, suitability or safety of any non-Atari part or any modification including labor which is performed by such distributor.



